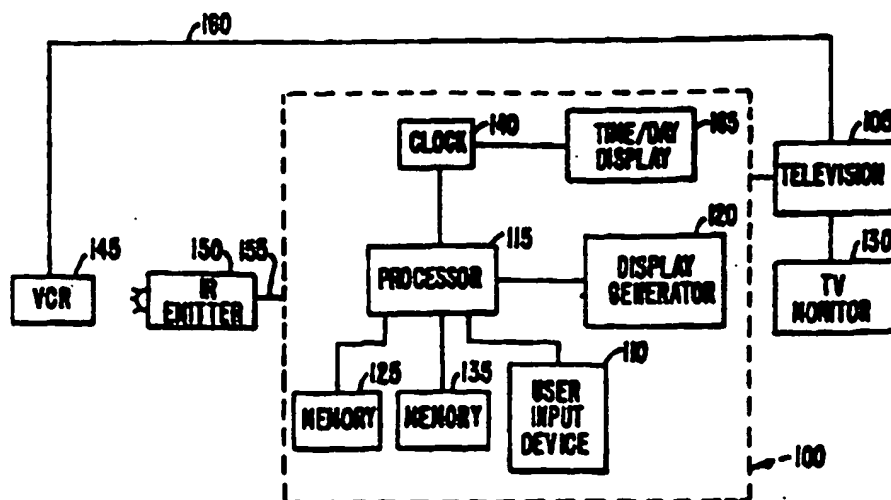




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(54) Title: VCR PROGRAMMING SYSTEM



(57) Abstract

An apparatus and method for programming a VCR (145) is provided. The system, utilizing a programming controller (100), presents a display on the viewer's television (130) which contains a pattern representing a plurality of time intervals. The user programs the controller by indicating what time intervals on what week and on what channel are to be recorded. The controller (100) then continuously compares the current time with the programmed time until a match is found. When a match is found the controller (100) activates the VCR (145), tunes the VCR (145) to the desired channel, and initiates recording. When the controller (100) determines that the VCR (145) has recorded for the desired length of time, it stops the VCR (145) from further recording and turns off the power to the VCR (145).

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VCR PROGRAMMING SYSTEM

5

BACKGROUND OF THE INVENTION

The present invention relates generally to a system for programming a VCR and, more particularly, to a system and process for allowing a television user to easily program a VCR to record future programs.

The difficulty of setting a VCR for automatic recording at a future date is notorious. Even users who are technically sophisticated will often make mistakes in the VCR programming procedure that cause them to record the wrong program or not to record anything at all. This difficulty has even resulted in a substantial body of humor dedicated to the subject of programming VCRs.

The difficulty of VCR programming has been alleviated somewhat by the development of VCRs that use a television set as a display for user prompts and feedback to the user during the programming process. U.S. Patent No. 4,908,713, issued March 30, 1990 to Michael R. Levine, discloses such a VCR using the television set as a display for VCR programming with an interactive user interface for directing the user on a step-by-step basis. Such a user interface removes a great deal of the mystery from VCR programming, but users still have difficulty with such a command-based interface and encounter problems carrying out the programming without making mistakes that cause them to miss recording programs they would like to watch at a different time than when they are broadcast.

Commonly assigned U.S. Patent No. 4,706,121, issued November 10, 1987 to Patrick Young, discloses a system and process in which user selections from television schedule information are used for automatic control of a VCR. That patent also contains a description of a proposed user interface for such a system and process. However, the provision of a highly intuitive user interface that makes such a system and process easy and convenient to operate is a difficult task. Further development of this system and

process has produced considerable change in the user interface as originally proposed.

From the foregoing, it is apparent that a simplified system for programming a VCR is desired.

5

SUMMARY OF THE INVENTION

The present invention provides a simple and convenient method and apparatus for programming a VCR. The system, utilizing a programming controller, presents a display on the viewer's television which contains a pattern representing a plurality of time intervals. The user programs the controller by indicating what time intervals on what week and on what channel are to be recorded. The controller then continually compares the current time with the programmed time until a match is found. When a match is found the controller activates the VCR, tunes the VCR to the desired channel, and initiates recording. When the controller determines that the VCR has recorded for the desired length of time, it stops the VCR from continuing to record and turns off the VCR's power.

In one embodiment of the invention, the programming display screen presents sufficient time indicators for a full seven day week. Each day is broken into 48 half hour intervals. The user is also able to select the week for which the programming instructions apply as well as whether the instructions apply once, on a daily basis, or on a weekly basis. After the user selects the recording time, day, and week, the controller requires that the user input the desired channel.

In another embodiment of the invention, the programming display screen presents a series of 1/2 hour time segments, beginning with the current time, for every channel of the user's television system. The user scrolls along the vertical axis to change the channel selection and scrolls along the horizontal axis to change the selected time interval.

A further understanding of the nature and advantages of the present invention may be realized by reference to the remaining portions of the specification and the drawings.

NOTE: Many of the names in the figures and/or specification may be the trademarks/servicemarks of others. Such names include "HBO" and "NBC."

5 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of an embodiment of the invention utilizing a stand-alone programming controller;

Fig. 2 is a block diagram of an embodiment of the invention in which the programming controller is integrated
10 into the VCR;

Fig. 3 is a block diagram of an embodiment of the invention in which the programming controller is integrated into a decoder box;

Fig. 4 is a flow chart illustrating the operation of
15 the preferred embodiment of the invention;

Fig. 5 is an illustration of the preferred embodiment of the VCR programming screen;

Fig. 6 is an illustration of a screen which prompts the user to select a specific program, a program representing
20 an individual set of VCR programming instructions;

Fig. 7 is an illustration of an alternate VCR programming screen according to the present invention which only shows a single day of programming time segments;

Fig. 8 is an illustration of a channel selection
25 screen;

Fig. 9 is an illustration of an alternate VCR programming screen according to the present invention which utilizes indicators instead of a grid structure; and

Fig. 10 is an illustration of an alternate VCR programming screen according to the present invention which
30 presents a series of time indicators adjacent to each individual channel.

DESCRIPTION OF THE PREFERRED EMBODIMENT

35 Fig. 1 is a block diagram of one embodiment of the invention. In this embodiment a programming controller 100 is coupled to a television 105. When programming controller 100 is activated by a user using an input device 110, a data

processor 115 coupled to a data generator 120 generates a VCR programming instructional display. The information for the blank instructional display is stored in memory 125, preferably a ROM device. The display is presented on a television screen 130. The user selects the time of day, the day of the week, and the channel on which programming is to be recorded. The user also indicates the desired duration of recording. All of the VCR programming information is stored in a memory 135. A clock 140, integral to controller 100, tracks the time of day as well as the day of the week. When processor 115 determines that the actual time of the day as well as the day of the week match the stored VCR programming instructions, processor 115 turns the power on VCR 145, adjusts the VCR tuner to the desired channel, and initiates recording. When processor 115 determines that the selected recording duration has been completed, recording on VCR 145 is stopped and the power to VCR 145 is turned off.

In the preferred embodiment of the invention, controller 100 controls VCR 145 with an IR emitter 150. IR emitter 150 is capable of emulating the infrared command instructions required by VCR 145. Typically IR emitter 150 is placed at the end of a cable 155. Cable 155 allows IR emitter 150 to be placed proximate to the IR receiver of VCR 145. If desired, a look-up table of emulation commands can be stored in memory 125 thus allowing IR emitter 150 to emulate the IR command instructions for a variety of VCRs. Preferably the user inputs the selected VCR into controller 100 using input device 110. Once a VCR has been selected, controller 100 determines the appropriate set of VCR commands utilizing the look-up table.

When the viewer wishes to play a prerecorded tape, the signal from VCR 145 to television 105 is sent via cable 160 as in a standard system. Furthermore, controller 100 does not inhibit the standard features of VCR 145. Therefore the viewer can still program VCR 145 using the standard programming techniques for which VCR 145 was originally designed, i.e., using a series of programming steps or a menu system displayed on television monitor 130.

Preferably, clock 140 is coupled to a read-out display 165. Display 165 shows the current time and day, thus allowing the user to easily check the accuracy of controller 100. In an alternate embodiment, the current time and day as recognized by clock 140 is presented on the VCR instructional display on television monitor 130, this display being shown whenever the programming controller is activated. Although this embodiment requires that the user activate controller 100 to determine the accuracy of clock 140, it has the advantage of size since controller 100 can now be further miniaturized. Furthermore, this embodiment allows the user to place controller 100 in a wider variety of locations since display 165 does not need to be easily viewable by the user.

Fig. 2 is a block diagram illustrating an alternate embodiment of the invention. In this embodiment programming controller 100 is within a VCR 205. VCR 205 is connected to a television 210 and at least one source 215. In this embodiment the clock which is integral to controller 100 is preferably the same clock as that utilized in the VCR.

Fig. 3 is a block diagram illustrating another embodiment of the invention. In this embodiment programming controller 100 is integrated into a stand-alone device, such as a decoder 305. Decoder 305 may be of the sort used with a cable source 310 or a satellite direct broadcast source 315. As in the system illustrated in Fig. 1, this embodiment of the invention requires an IR emitter 320 to control a VCR 325. Typically a television 330 is connected directly to VCR 325 although in some systems it may be connected directly to decoder 305.

In an alternate embodiment, very similar to that illustrated in Fig. 3, controller 100 is integrated into a personal computer (PC). In this embodiment the PC may be used in conjunction with the television system to supply the user with capabilities such as Internet access. The functionality of controller 100 can be easily integrated into the PC.

Fig. 4 is a flow chart illustrating the operation of the preferred embodiment of the invention. To program the user's VCR, the user turns on the television system (step

405), sets the television to the appropriate channel (step 410), and activates the programming controller (step 415). The television must be set to a predetermined channel since the programming controller only sends out programming information over a narrow frequency band. In the preferred embodiment the user is given a choice of channels, typically channels 3 and 4. The programming controller includes a switch which allows the user to select the corresponding channel, preferably the channel with the least use in the viewer's geographic region.

After the controller has been activated, in the preferred embodiment of the invention the user is prompted to input an instruction set number (step 420). Although this step is not required, in the preferred embodiment of the invention the user is allowed to input several sets of VCR programming instructions into the controller. Therefore in this embodiment the user is able to use the controller to record numerous programs. Preferably the controller tracks the number of instructional sets entered and unexecuted to date and prompts the user to select the next number in the series. This system also allows the user to go back to a previously entered set of programming instructions and modify those instructions.

In the next step of programming the controller a display is presented on the viewer's television (step 425). The display contains a pattern representing the times of day, preferably in 30 minute increments and for each day of a seven day week. After deciding the desired recording time, typically using a printed program guide (step 430), the user selects the corresponding times from the display pattern (step 435). In the preferred embodiment of the invention, after the user selects the recording time and date, a prompt appears asking the user to input the desired channel (step 440). The user inputs the channel, preferably by pressing the number on a remote control (step 445). The set of VCR instructions comprised of the record start time, record stop time, day of the week, and channel are stored within the controller (step 450).

After the user has input the set of VCR programming instructions, the controller displays the selected information and asks the user to verify that the proper choices have been stored (step 455). Assuming that the user neither modifies
5 the current set of instructions or seeks to input additional instructions, the user deactivates the controller and resumes the normal use of the television (step 460).

The controller continuously monitors the current time and day, comparing the data with the stored VCR
10 programming instructions (step 465). When the current time is greater than or equal to the stored start time (step 467), the controller turns on the VCR (step 470), tunes the VCR to the selected channel (step 475), and initiates recording (step 480). When the controller determines that the current time is
15 greater than or equal to the desired stop time (steps 485 and 487), the controller stops the recording (490), turns off the VCR (step 495), and erases the set of programming instructions from the controller memory (step 499).

Fig. 5 is an illustration of the preferred
20 embodiment of a VCR programming screen 500. Screen 500 is divided into a seven day grid. The day of the week is indicated in a portion 505. Adjacent to each day of the week 505 is a linear grid 510. Grid 510 divides each 24 hour day into 48 half hour increments.

25 In the preferred embodiment, the user selects the times over which recording is desired, for example by moving a cursor to the desired time slot and pressing ENTER. In order to aid the user in navigating through the programming screen, preferably each grid segment becomes temporarily highlighted
30 as the cursor passes over it. Thus if the user wishes to record a program on Thursday night starting at 9:00 PM and ending at 9:30 PM, the user simply moves the cursor to the 9:00 PM slot for Thursday night and presses enter. In the preferred embodiment, if the user wishes to record a program
35 which lasts longer than 30 minutes, the user moves the cursor to each successive time slot and presses enter.

After the user indicates a specific day and time period, in this embodiment the program guide requests that the

user enter a channel number. In one embodiment screen 500 begins flashing a question mark (i.e., "?") in a portion 520 adjacent to the day of the week on which recording has been requested. The system can also be designed to send the user a request to input the desired channel, for example by scrolling a request message across screen 500 in area 525.

Once the user has indicated the time, day, and channel for recording, the system may notify the user that either the programming has been successfully completed or that the programming was not successfully completed. An example of why the programming may have been unsuccessful is that the user programmed the system to record two different channels at the same time.

In one embodiment of the invention, the system allows the user to input several sets of VCR programming instructions. Preferably in this embodiment when the user initiates the system a screen 600 appears, as illustrated in Fig. 6. Screen 600 prompts the user to select a specific PROGRAM, in this case a program refers to a set of VCR programming instructions. Typically the user would select a program using either a cursor, or by simply typing in the desired number on the remote keypad. If the user wants to modify a previously input program, they simply select the representative program number. The system can be designed to prompt the user as to the next available program, for example by flashing the number of the next available program.

Due to the limited resolution of a standard television screen as seen from a standard viewing distance, a screen which conveys less information than screen 500 may be preferable. Fig. 7 is an illustration of a screen 700. Instead of showing information for a full 7 day schedule, screen 700 only provides a single day of programming. The day of the week for which the programming information is provided is shown in a cell 705. Preferably the day shown in portion 705 is the current day. If the user wishes to input programming instructions for a later day, the user scrolls through the days using DAY UP and DAY DOWN buttons on the remote control device. In order to conserve space, simple

arrow buttons can be used, thus allowing the same buttons to be used for a variety of functions.

Screen 700 breaks the 24 hour day into 48 individual thirty minute intervals. Although the 48 intervals can be presented in a variety of ways, preferably they are spread throughout four rows 710. To help the user navigate through the grid, above each row is a time of day descriptor 715 such as AFTERNOON. Another aid to user navigation is to color code the time segments. For example, all segments 720 representing hours (e.g., 12, 1, 2, etc.) may be of one color while all segments 725 representing 1/2 hours (e.g., 12:30, 1:30, 2:30, etc.) may be of a second color.

In an embodiment of the invention utilizing screen 700, once the user has selected the day and time, a separate screen 800 is displayed. Screen 800 is a channel selection screen. Screen 800 has a table of channel numbers 805 from which the user selects the desired channel. Preferably screen 800 is limited to the channels available on the user's television system, thereby avoiding confusion and minimizing errors. For example, in screen 800 a "-" is shown at portion 810 between channels 3 and 5, thus indicating that channel 4 is not available through the user's television system. Another aid to identifying channels is the use of broadcaster designators, for example HBO and NBC shown at 815.

Fig. 9 is an illustration of an alternate programming screen 900. Screen 900 is similar to screen 500 in that 7 days of time intervals are shown in a single screen. However, the layout of screen 900 permits larger numbers 905 representing the times, thus making the screen more readable from a distance. For each day 910 only a single set of numbers 905 are required. Above and below each number is an indicator 915, such as a circle, the indicators above the numbers representing AM times and the indicators below the numbers representing PM times. In between each hourly indicator is a 1/2 hour indicator 920. Preferably indicators 920 are easily distinguishable from indicators 915, for example by size or color.

Fig. 10 is an illustration of an alternate programming screen 1000. Screen 1000 is divided between channel indicators 1005 and time indicators 1010. Preferably the first time indicator 1015 for each channel represents the current time. Thus in screen 1000 the current time 1015 must be 1:00 since the next time 1010 following the current time is 1:30. In using this screen, the user scrolls down the screen in a direction 1020 until the desired channel is found, potentially scrolling through numerous pages or screens. After finding the desired channel, the user scrolls in a direction 1025 until the desired recording time is found, also potentially scrolling through numerous pages or screens.

In an alternate embodiment of the invention, prior to initiating recording the programming controller 100 determines if the VCR is in a power on or power off state. If the VCR is in a power on state, when the programming controller determines that it is time to begin recording, it simply tunes the VCR tuner to the selected channel and initiates recording, thus eliminating step 470 illustrated in Fig. 4. If, on the other hand, the VCR is in a power off state, the programming controller turns the VCR on before initiating recording. This feature eliminates the risk of missing a planned recording session due to the user inadvertently leaving the VCR's power on.

In an alternate embodiment of the invention, after a set of VCR programming instructions has been input into the programming controller, the programming controller determines whether or not the VCR contains a tape. This feature is most easily added to a controller which is integral to the VCR as illustrated in Fig. 2.

In an alternate embodiment of the invention, the VCR programming screen allows the user to select the week for which the VCR programming instructions are to apply. For example, a portion 925 of screen 900 lists weeks 1 through 4. Therefore if a user wishes to record a 1/2 hour program at 8:30 PM, a week from tomorrow, the user would first select "2" from portion 925 to indicate that the desired program is not shown at 8:30 PM tomorrow, but rather a week from tomorrow.

Another feature which can be implemented with the present invention is illustrated in portion 930 of Fig. 9. Portion 930 lists three choices for the user: ONCE, DAILY, WEEKLY. If the user selects ONCE, then the VCR programming instructions input by the user will be applied once and then
5 erased from memory. If the user selects DAILY, then every day at the same time the controller will cause the VCR to record the designated time slot until this instruction is erased by the user. If the user selects WEEKLY, then every week at the
10 same time and the same day of the week, the controller will cause the VCR to record the designated time slot until this instruction is erased by the user.

As will be understood by those familiar with the art, the present invention may be embodied in other specific
15 forms without departing from the spirit or essential characteristics thereof. Accordingly, disclosure of the preferred embodiment of the invention is intended to be illustrative, but not limiting, of the scope of the invention which is set forth in the following claims.

WE CLAIM:

1 1. A VCR programming system, comprising:
2 a programming controller coupled to a VCR and a
3 television;
4 a clock coupled to said programming controller
5 providing a time of the day and a day of the week;
6 a switching mechanism coupled to said programming
7 controller for activating and suspending operation of said VCR
8 programming system;
9 a display generator coupled to said programming
10 controller for generating a display screen containing a VCR
11 programming instructional display, said programming
12 instructional display comprised of a pattern of markings
13 representative of a plurality of individual time segments,
14 wherein said pattern represents at least one day of the week;
15 a pointing device for selecting at least one of said
16 individual time segments, wherein selection of said time
17 segment causes said programming controller to store a set of
18 VCR programming instructions within a storage memory, said
19 storage memory coupled to said programming controller, and
20 said set of VCR programming instructions including a start
21 time and a stop time; and
22 a channel designator for inputting a specific
23 channel into said programming controller, said input specific
24 channel stored within said set of VCR programming
25 instructions, wherein said programming controller utilizes
26 said VCR programming instructions to control said VCR.

1 2. The VCR programming system of claim 1, wherein
2 said pattern of markings is a blank grid.

1 3. The VCR programming system of claim 1, further
2 comprising a week designator for inputting a specific week
3 into said programming controller, said specific week stored
4 within said set of VCR programming instructions.

1 4. The VCR programming system of claim 1, wherein
2 said programming controller can accept a plurality of sets of
3 VCR programming instructions.

1 5. The VCR programming system of claim 4, further
2 comprising a program designator for indicating a particular
3 set of VCR programming instructions from said plurality of VCR
4 programming instructions.

1 6. The VCR programming system of claim 1, wherein
2 said plurality of individual time segments is sufficient to
3 represent each day of a seven day week.

1 7. The VCR programming system of claim 1, wherein
2 each of said plurality of individual time segments represents
3 a 30 minute durational time period.

1 8. The VCR programming system of claim 1, wherein
2 said pointing device is a cursor on said display screen, said
3 cursor highlighting said selected time segments.

1 9. The VCR programming system of claim 8, further
2 comprising a remote controller for manipulating said cursor.

1 10. The VCR programming system of claim 1, further
2 comprising an IR emitter coupled to said programming
3 controller, said IR emitter controlling said VCR.

1 11. The VCR programming system of claim 1, wherein
2 said VCR programming system is resident within a device
3 selected from the group consisting of a stand-alone device, a
4 decoder box, a television guide system, a television, a TVCR,
5 and a VCR.

1 12. A VCR programming system, comprising:
2 a programming controller coupled to a VCR and a
3 television;
4 a clock coupled to said programming controller
5 providing a time of the day and a day of the week;
6 a switching mechanism coupled to said programming
7 controller for activating and suspending operation of said VCR
8 programming system;
9 a display generator coupled to said programming
10 controller for generating a display screen containing a VCR
11 programming instructional display, said programming
12 instructional display comprised of a pattern of markings
13 representative of a plurality of individual time segments,
14 wherein said pattern represents at least one day of the week;
15 a pointing device for selecting at least one of said
16 individual time segments, wherein selection of said time
17 segment causes said programming controller to store a set of
18 VCR programming instructions within a storage memory, said
19 storage memory coupled to said programming controller, and
20 said set of VCR programming instructions including a start
21 time and a program duration; and
22 a channel designator for inputting a specific
23 channel into said programming controller, said input specific
24 channel stored within said set of VCR programming
25 instructions, wherein said programming controller utilizes
26 said VCR programming instructions to control said VCR.

1 13. A method of programming a VCR, said method
2 comprising the steps of:
3 activating a programming controller, said
4 programming controller coupled to said VCR and a television;
5 generating a display with said programming
6 controller, said display presented on a screen coupled to said
7 television, said display comprised of a pattern of markings
8 representative of a plurality of individual time segments,
9 wherein said pattern represents at least one day of the week;
10 selecting at least one of said individual time
11 segments;

12 storing within a memory coupled to said programming
13 controller a set of VCR programming instructions based on said
14 selected individual time segment, said set of VCR programming
15 instructions including a start time, a stop time, and a day of
16 the week;
17 inputting a channel designator into said VCR
18 programming controller, wherein said channel designator is
19 stored within said set of VCR programming instructions;
20 storing within said VCR programming instructions
21 said input channel designator;
22 determining a clocked time of the day and a clocked
23 day of the week with a clock coupled to said programming
24 controller;
25 comparing said clocked time of the day and said
26 clocked day of the week with said VCR programming
27 instructions;
28 initializing a recording function on said VCR with
29 said programming controller when said clocked time of the day
30 and said clocked day of the week correspond to said start time
31 and said day of the week;
32 tuning said VCR to a VCR channel corresponding to
33 said input channel designator with said programming
34 controller; and
35 ending said recording function on said VCR with said
36 programming controller when said clocked time of the day and
37 said clocked day of the week correspond to said stop time and
38 said day of the week.

1 14. The method of claim 13, wherein said pattern of
2 markings is a blank grid.

1 15. The method of claim 13, further comprising the
2 steps of:

3 inputting a program designator into said VCR
4 programming controller, said program designator indicating a
5 specific set of VCR programming instructions from a plurality
6 of sets of VCR programming instructions; and

7 chronologically ordering said plurality of sets of
8 VCR programming instructions.

1 16. The method of claim 13, wherein said plurality
2 of individual time segments is sufficient to represent each
3 day of a seven day week.

1 17. The method of claim 13, wherein each of said
2 plurality of individual time segments represents a 30 minute
3 durational time period.

1 18. The method of claim 13, wherein said selecting
2 step is further comprised of the step of highlighting said
3 selected time segments.

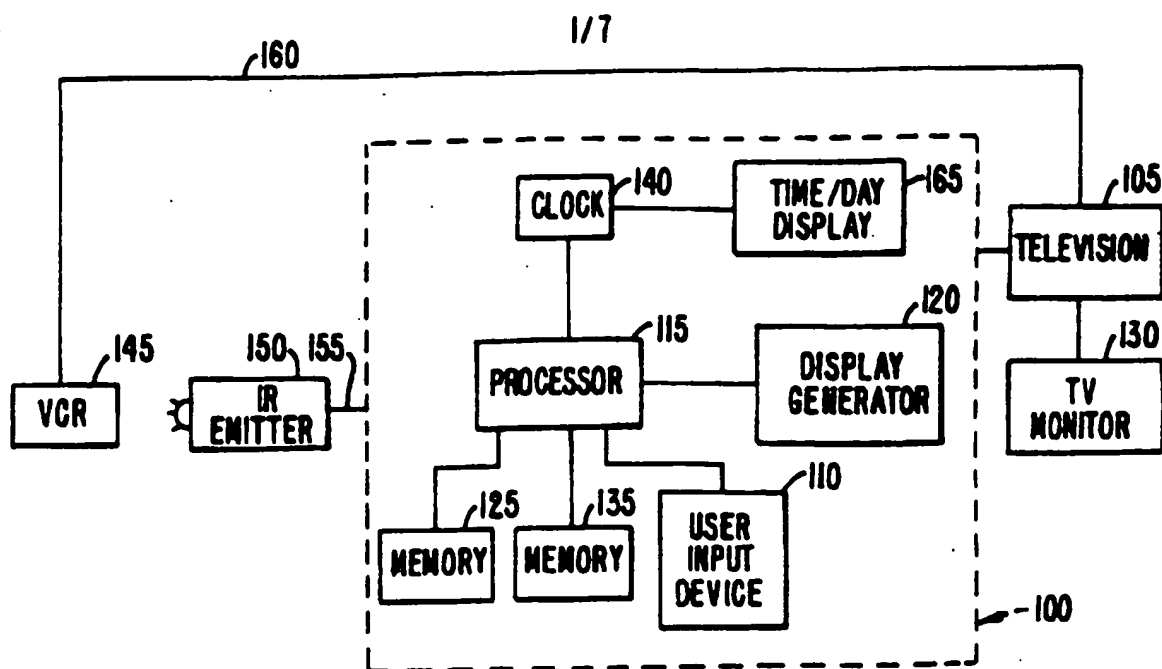


FIG. 1.

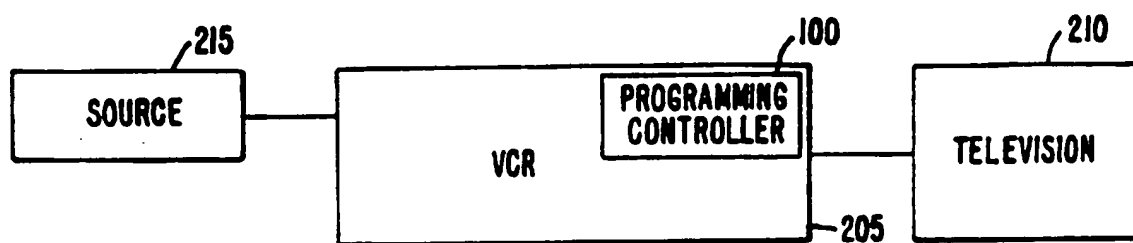


FIG. 2.

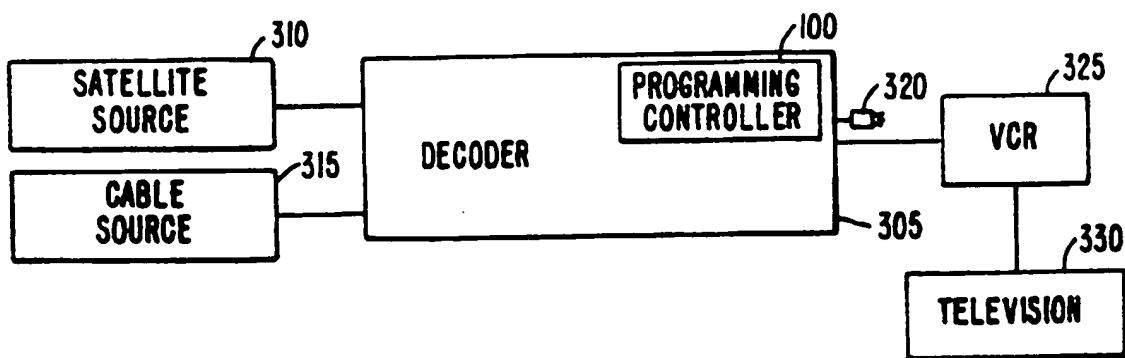
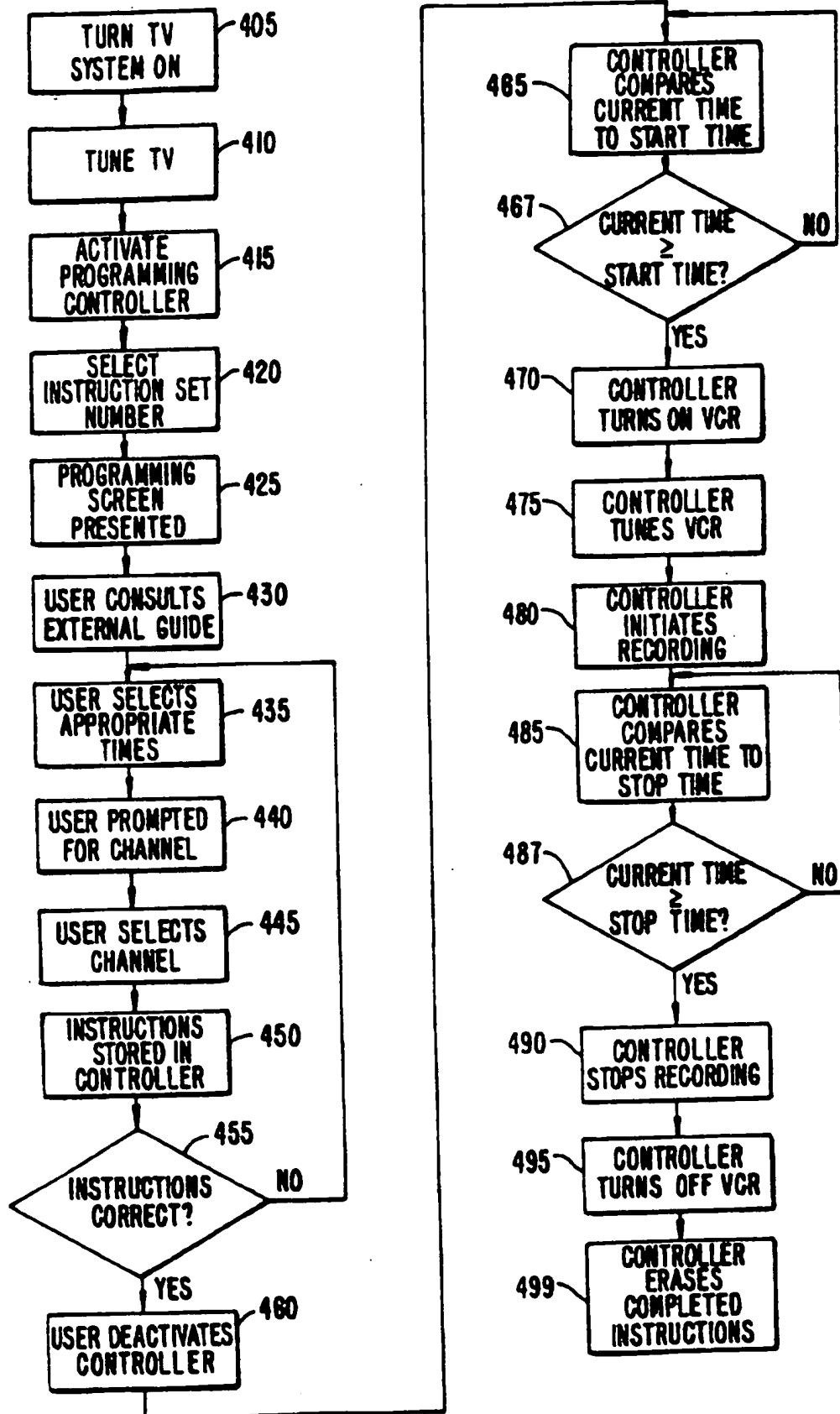


FIG. 3.

2/7



QUOTIENTE SOSTA / RILEV 9A)

5. 16.

CHANNEL

MONDAY — 505

510

1

1/2

2

1/2

3

1/2

4

1/2

5

1/2

6

1/2

7

1/2

8

1/2

9

1/2

10

1/2

11

1/2

12

1/2

AM

1

1/2

2

1/2

3

1/2

4

1/2

5

1/2

6

1/2

7

1/2

8

1/2

9

1/2

10

1/2

11

1/2

12

1/2

PM

TUESDAY

?

1

1/2

2

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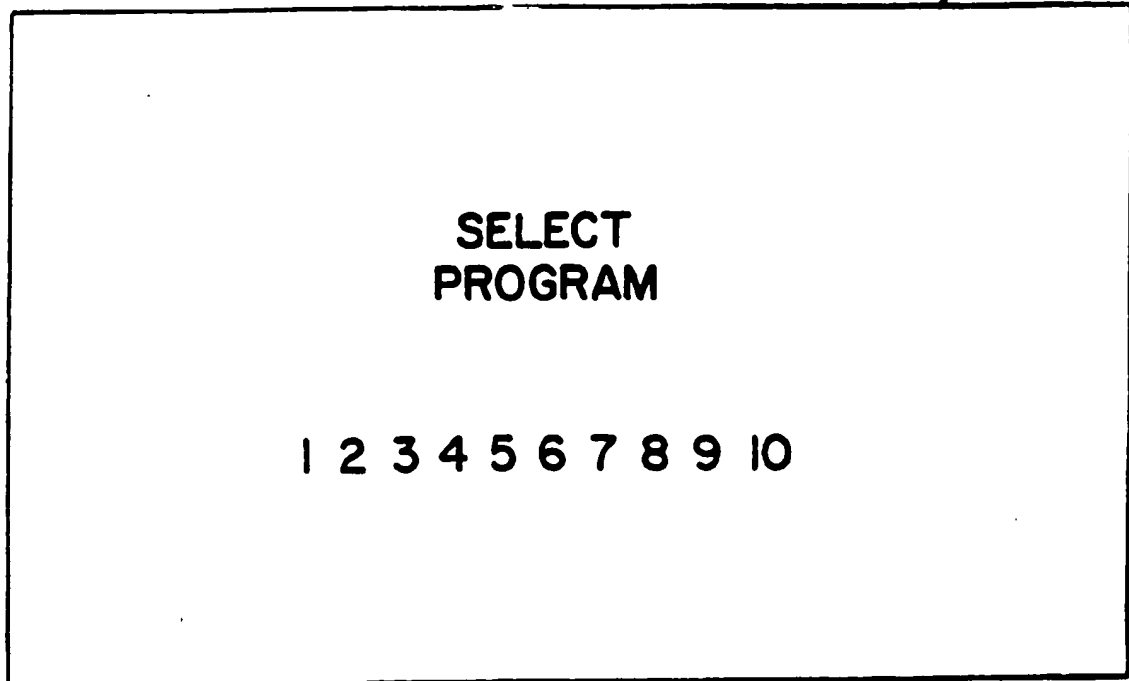


FIG. 6.

800

✓ 805	9	17	-	33	41
2 NBC	10	-	26	-	42
3 815	-	19	27	-	43
- 810	12	20 805	28	-	44
5	-	21	-	805 37	45
6 HBO	14	-	30	38	46
7 815	15	-	31	39	47
-	16	24	32	40	48
CHANNEL ?					

FIG. 8.

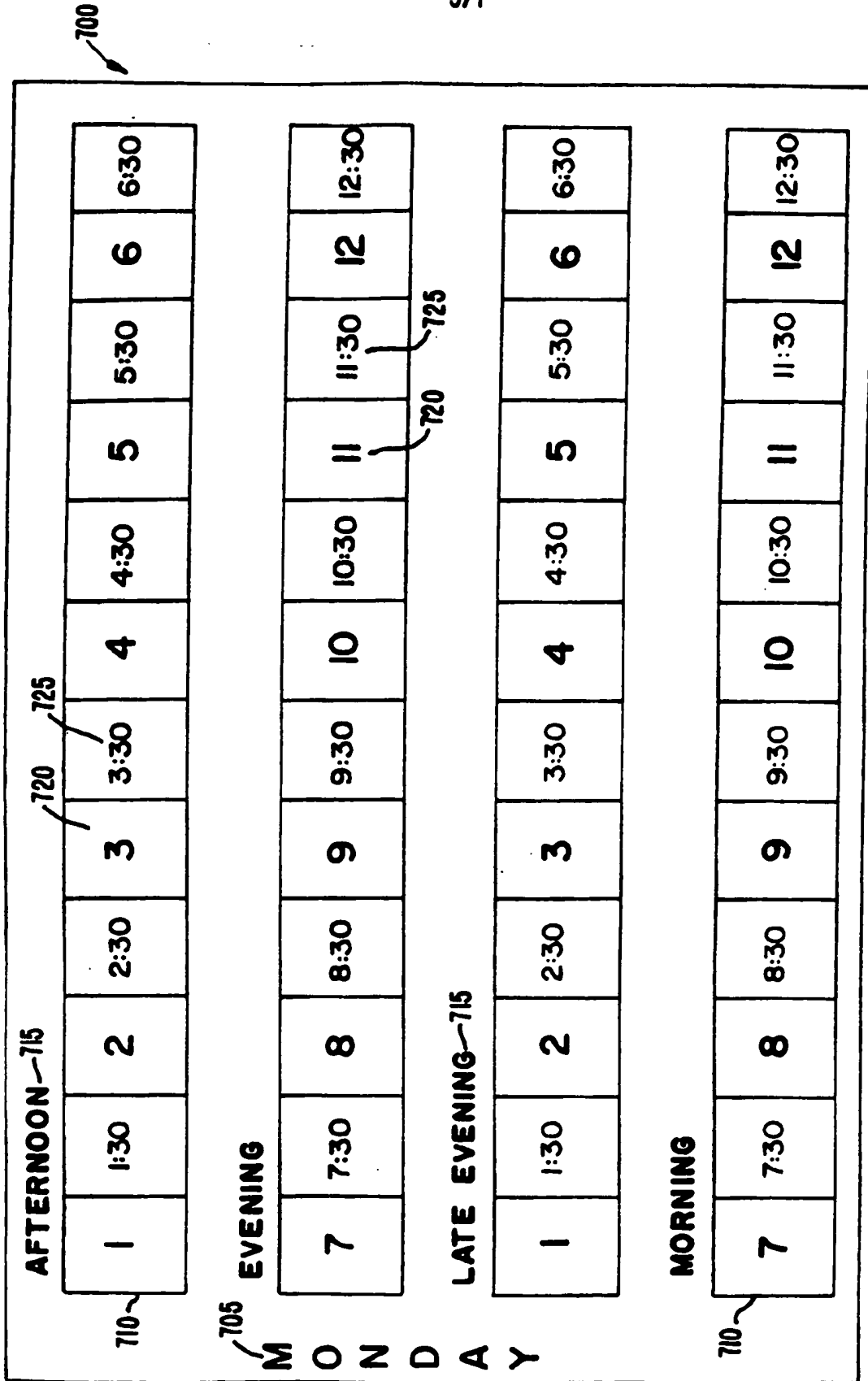


FIG. 7.

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900

	WEEK 1 2 3 4				ONCE DAILY WEEKLY 1-930													
	1	2	3	4	5	6	7	8	9	10	11	12						
MONDAY	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
TUESDAY	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
WEDNESDAY	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
THURSDAY	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
FRIDAY	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
SATURDAY	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
SUNDAY	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

905 (points to 7)
 920 (points to 5)
 915 (points to 2)
 910 (points to TUESDAY)
 910 (points to THURSDAY)

FIG. 9.

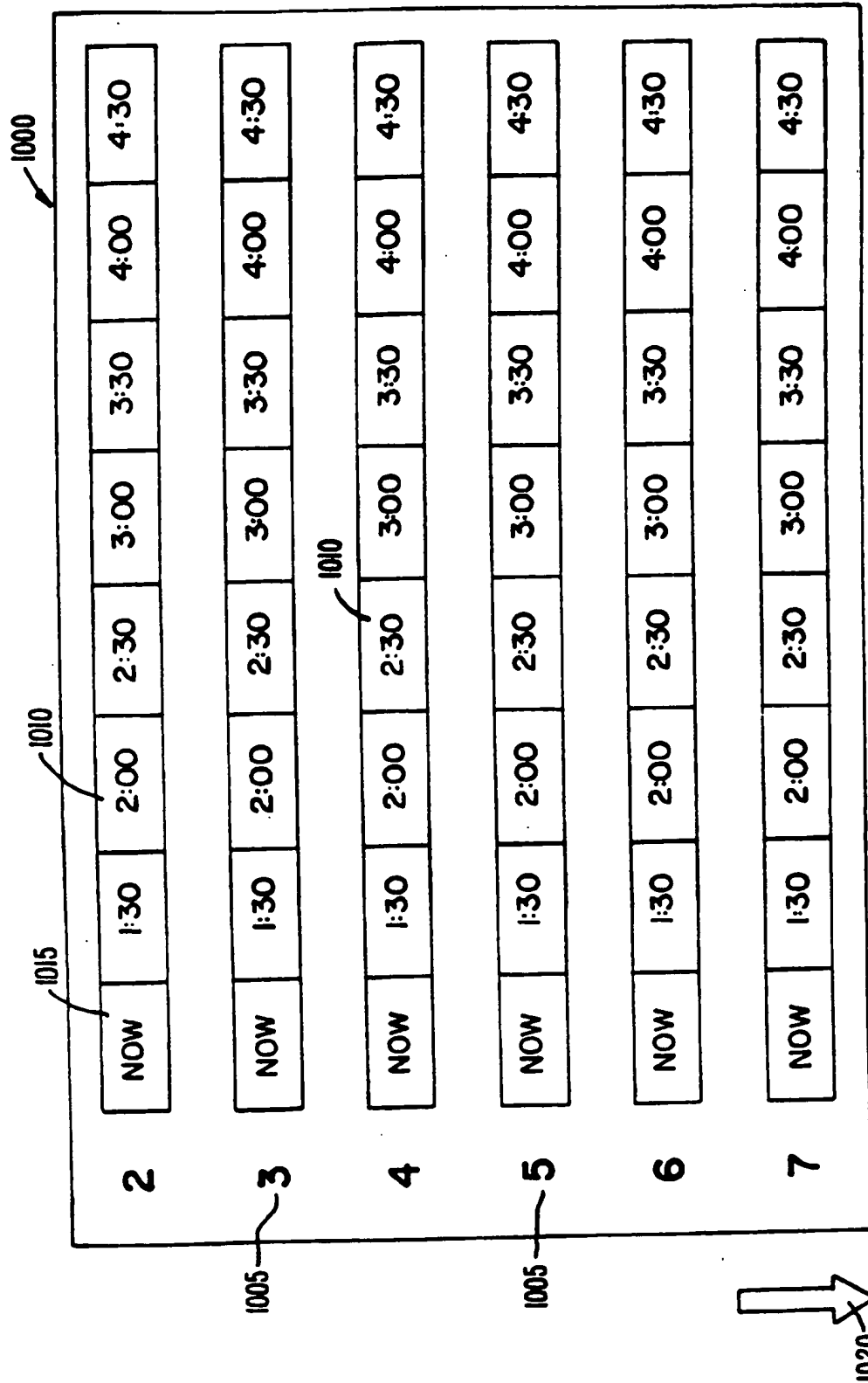


FIG. 10.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US97/11742

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : H04N 5/76

US CL : 386/83

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 386/83, 46; 348/906

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,479,266 A (YOUNG ET AL) 26 December 1995, whole document.	1-18
Y	US 4,847,696 A (MATSUMOTO ET AL) 11 July 1989, whole document.	1-18
Y	US 4,706,121 A (YOUNG) 10 November 1987, col. 5, lines 25-45, col. 9 lines 1-36.	1-18
Y	US 4,873,584 A (HASHIMOTO) 10 October 1989, col. 2.	7 and 17

☐ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

"	Special categories of cited documents:	"T	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"A"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

02 SEPTEMBER 1997

Date of mailing of the international search report

30 OCT 1997

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